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I. Model Problems

A **monomial** is an expression that is a number, variable or product of a number and variables. Examples of monomials: -3 , $4x$, $5xy$, y^2

To multiply monomials, multiply all the coefficients and all the variables.

Example 1 Simplify $3x^2(5x^3)$.

$$= 15x^2x^3$$

Multiply the coefficients.

$$= 15x^5$$

Multiply variables.

The answer is $15x^5$.

To divide monomials, divide the coefficients and the variables.

Example 2 Simplify $\frac{8x^3y^5}{4x^2y^3}$.

$$= \frac{2x^3y^5}{x^2y^3}$$

Divide the coefficients.

$$= 2xy^2$$

Divide variables.

The answer is $2xy^2$.

If the coefficients do not divide evenly, reduce the ratio of coefficients as if it were a fraction.

Example 3 Simplify $\frac{15x^{10}}{12x^7}$.

$$= \frac{5x^{10}}{4x^7}$$

Reduce the ratio of coefficients.

$$= \frac{5}{4}x^3$$

Divide variables.

The answer is $\frac{5}{4}x^3$

II. Practice

Simplify.

1. $8x^5(3x)$

2. $-90x^3(5x^5)$

3. $-5x^3(3x^7)$

4. $15x^4(3x^9)$

5. $10x^2y^5(9x^3y)$

6. $-100x^2y^4(5x^{10}y^9)$

7. $-8x^6y^{10}(-5x^6y^8)$

8. $10x^{20}y(x^3y^{90})$

9. $9x^2y^9(8x^{10}y^9)$

10. $-11x^2(11x^6y^{10})$

11. $\frac{30x^{10}}{5x^3}$

12. $\frac{32x^{12}}{2x^{10}}$

13. $\frac{55x^6}{11x^2}$

14. $\frac{16y^5}{8y^3}$

15. $\frac{80x^5y^7}{4x^2y^3}$

16. $\frac{-25x^7y^9}{5x^2y^7}$

17. $\frac{-70x^8y^{10}}{10x^3y^7}$

18. $\frac{60x^9y^5}{4x^6y^4}$

19. $\frac{10x^8y^5}{4x^2y^5}$

20. $\frac{6x^5y^5}{12x^4y}$

21. $\frac{20x^3y^8}{30x^3y^7}$

22. $\frac{144x^5y^{18}}{12x^4y^2}$

III. Challenge Problems

23. What is the area of a rectangle with length $7xy^2$ inches and width $(8x^2y)$ inches? Write your answer as an expression in terms of x and y .

24. Use $\frac{x^2}{x^2}$ and the rules of dividing monomials to explain why $x^0 = 1$.

25. Correct the Error

There is an error in the student work shown below:

Question: Simplify $\frac{80x^9}{16x^4}$.

Solution:

$$\begin{aligned} & \frac{80x^9}{16x^4} \\ &= \frac{64x^9}{x^4} \\ &= 64x^5 \end{aligned}$$

What is the error? Explain how to solve the problem.

IV. Answer Key

1. $24x^6$
2. $-450x^8$
3. $-15x^{10}$
4. $45x^{13}$
5. $90x^5y^6$
6. $-500x^{12}y^{13}$
7. $40x^{12}y^{18}$
8. $10x^{23}y^{91}$
9. $72x^5y^6$
10. $-121x^8y^{10}$
11. $6x^7$
12. $16x^2$
13. $5x^4$
14. $2y^2$
15. $20x^3y^4$
16. $-5x^4y^2$
17. $-7x^5y^3$
18. $15x^3y$
19. $(5/2)x^6$
20. $(1/2)xy^4$
21. $(2/3)y$
22. $12xy^{16}$
23. $56x^3y^3 \text{ in}^2$
24. $x^2/x^2 = x^{2-2} = x^0$. since $x^2 = x^2$, $x^2/x^2 = 1$, so $x^0 = 1$ as well
25. The student subtracted the coefficients instead of dividing. The correct answer is $5x^5$.